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A gamma-ray burst rapid-response observatory in the US Virgin Islands

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1. Gamma-ray burst counterparts and afterglows

In the last few years, small observatories dedicated to GRB rapid-response are playing a crucial role in deciphering the physics of Gamma-Ray Bursts (GRBs). Observatories housing small telescopes have the advantage of a rapid response to catch the early optical emission from the burst. A global network of small rapid response telescopes that cover a broad range of longitude is necessary to extend the time base of the counterpart and afterglow observations. Telescopes near the equator provide broad sky coverage of both celestial hemispheres.

2. The observing site

The site is situated near the crest of Crown Mountain on the island of St. Thomas in the US Virgin Islands. The observing site is strategically located at 65 W longitude, placing it as the most eastern GRB-dedicated observing site in the western hemisphere. This will help bridge the gap between the Canary Islands and South America and the eastern US.

The site is equipped with two weather monitors: (1) a Davis weather station, (2) a Campbell Scientific weather station, with a 256 Kb climate datalogger. Temperature, rainfall, humidity, wind speed/direction, and solar flux are logged in 1.024 s intervals (with 2 minute averages) and continuously monitored by the weather daemon running within the Talon observatory control software. Since the Caribbean trade winds generally blow from the east, orographic lifting generally occurs on the eastern portion of the island, forming clouds. These clouds tend to deposit their moisture on the slope closest to where they form, east of Crown mountain. Preliminary results from the weather station data (1/9/04-3/26/04) show that the relative humidity is highest with northeasterly and southeasterly wind direction.

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3. Rapid-response observing program

The objectives of our GRB rapid response observing program are to (1) observe prompt optical GRB emission and place constraints on reverse external shock emission, (2) observe early afterglow and fill in the gaps in the afterglow light curves, (3) measure pre- and post-break temporal slopes and break times in afterglow light curves, and (4) measure afterglow colors to constrain the ordering of the synchrotron break frequencies ν_m and ν_c.

The observatory is equipped with a 0.5 m robotic telescope (see Neff et al., these proceedings) and a Marconi 42-40 2048×2048 CCD with BVRI filters. Via the GCN network, the telescope will respond to triggers from the BAT and XRT onboard the Swift spacecraft. The field of view is identical to that of the XRT, 19×19 arc minutes. Once a GCN noticed is received via a socket connection, a Perl script will parse the Talon scheduling file, which is constantly monitored for updates by the telrun daemon. Provided the weather parameters are met, the dome shutter will automatically open. A predefined GRB observing scheme will then be implemented that initially takes a series of 60 s exposures in the R filter for the first hour after the burst trigger. A script will process the images, then compare with known objects in the USNO-B1.0 catalog. Rapid response images of GRB error boxes will be posted online at http://astro.uvi.edu.

4. Status

The 0.5 m is currently in a calibration and testing phase to maximize performance for GRB response. In late July a new pointing model will be constructed to maximize the pointing accuracy, and the dome will be integrated with the Talon observatory control software. The dome automation will be the limiting factor in our response time (10-60 s). We expect to have the system calibrated for automatic GRB response by the time Swift launch in October 2004.